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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Lighted Collars to Aid Night Observations of Mule Deer

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Neck collars with lights were developed which permitted mule deer (*Odocoileus hemionus*) to be identified and observed at night. The light intensity and/or blinking sequence of the battery-powered neon lights was varied to allow identification of four individuals. Collars cost approximately $80 each.

Keywords: *Odocoileus hemionus*, night observation.

Wildlife managers and researchers have been limited in behavioral studies of animals by their inability to conduct accurate observations at night. Various systems have been used to monitor nighttime activities of different wildlife species (Richter 1955, Ozoga and Gysel 1965, Swanson and Sargeant 1972, and Reed et al. 1973). A major difficulty with any system is identification of individual animals.

Dr. K. E. Hungerford, University of Idaho, originally suggested using a harness or collar, with a battery-powered blinking neon light attached, that fitted on the animal. Prenzlow (1968, 1969) pursued this idea, and developed pulsating light units attached to neck collars that allowed identification of individual elk in pens.

The development of an identification system based on pulsating neon light units attached to deer neck collars is described here. This system permitted 24-hour observation of daily activities of four individual deer during three weekly periods in January and February 1976. These observations are part of a cooperative research study conducted by the Colorado Division of Wildlife and Rocky Mountain Forest and Range Experiment Station to estimate the capacity of winter ranges to support mule deer.

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Study Area and Methods

Four tame, trained (Reichert 1972) mule deer (*Odocoileus hemionus*) were enclosed in a 4-ha pasture at the Junction Butte Research Center near Kremmling, Colorado for 45 days. The pasture is located on typical big sagebrush (*Artemisia tridentata*) winter range on a gently sloping southwestern aspect.

Deer were observed 24 hours a day for 5 consecutive days during periods January 11-16, 25-30, and February 8-13, 1976. Four observers, each working 6 hours, observed the deer from a 4.6-m high observation tower, centrally located to permit maximum visibility. Maximum distance from the tower to any point in the pasture was 250 m. A model 221 night viewing device developed by Appollo Lasers, Javelin Division of

Los Angeles, California[3], equipped with a 300-mm telephoto lens, was used to monitor nighttime activities of the deer.

Each deer was fitted with a collar equipped with four battery-operated neon lights (fig. 1) designed to give separate light sequences and intensities. Light intensity and/or flash sequences

Figure 1.—Tame mule deer with collar and attached lights.

identified individual deer. Two lamps were positioned on each side of the collar, either parallel or perpendicular to the axis of the deer's neck, to give the following four light patterns: (1) parallel with all lamps constantly lighted (fig. 2); (2) perpendicular with two lamps constantly lighted and two lamps blinking slowly (1 blink per 2 sec) (fig. 3); (3) perpendicular with all lamps blinking rapidly (2 blinks per sec); (4) parallel with all lamps blinking slowly (1 blink per 2 sec). Light intensity of neon lamps was determined by maximum light tolerable to the night viewing device. The four collars were of different colors to aid in identification of deer during daylight.

[3]*Trade names and company names are used for the benefit of the reader and do not imply endorsement or preferential treatment by the U.S. Dep. Agric., or Colo. Div. of Wildlife.*

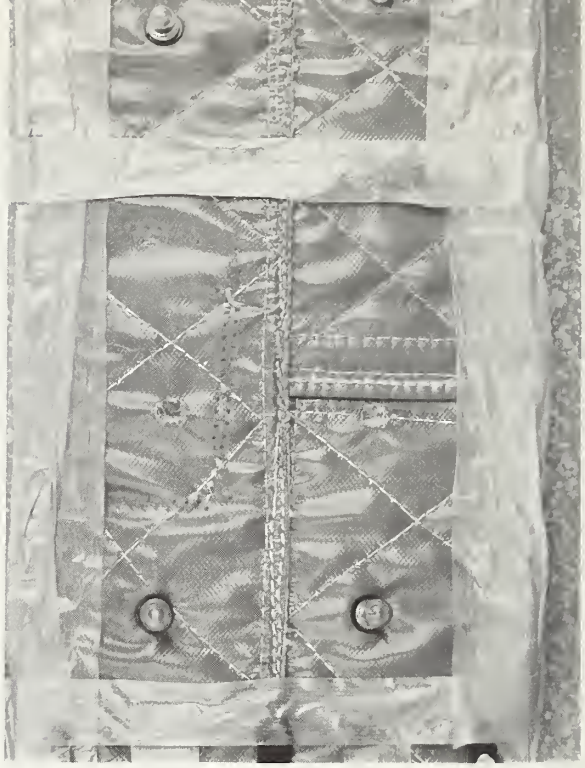
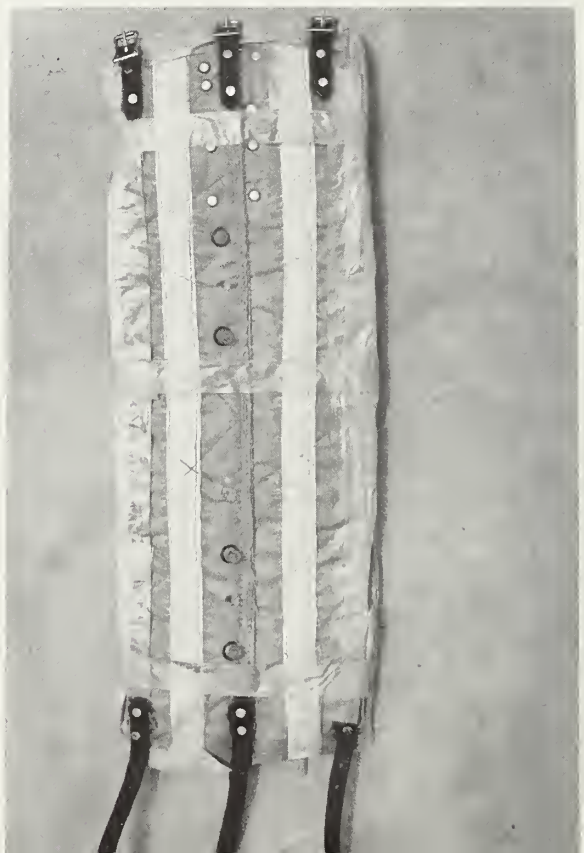


Figure 2.—Position of 4 lamps on neck collars. (Lights shown in "parallel" pattern).

Figure 3.—Leather straps with buckles were attached to each collar to facilitate application and removal. (Lights shown in "perpendicular" pattern).



Collar Construction and Design

To accommodate electrical components, two standard polyvinyl deer neck collars each 17.8 by 55.9 cm were stitched together to form one collar 35.6 cm wide. Three adjustable leather straps with buckles were riveted to each collar (fig. 3). Four holes were punched into each collar and fitted with lamp holders to secure lamps. Seven battery holders with 22.5-volt batteries were riveted on the inside of the collar to provide a series hookup of 157.5 volts. This voltage was necessary to activate four neon lamps and maximize life expectancy of each collar. Electrical connections were soldered to insure reliability of the units, and all exposed wires, sockets, and batteries were protected by wrapping with reinforced fiberglass tape. A covering of foam rubber 2.5 cm thick was secured to the inside of the collar. This material protected the deer from the attached hardware, and served as heat and moisture insulation for the electronic components.

Four capacitors (1 mfd 200) and four resistors (0.5 watt) were used for blinking light circuits. The resistor regulated the current and the time needed to charge the capacitor to a minimum of 105 volts. Once charged, the lamp flashed, discharging the capacitor; the sequence was repeated as long as batteries maintained necessary current. The blinking rate was determined by R x C = T; where R = resistance, C = capacitance and T = time. The intensity of light for constant-light circuits (fig. 4) was determined by the value of the resistor. Weight of each collar fully equipped was approximately 690 grams. Materials and costs for each collar are presented in table 1.

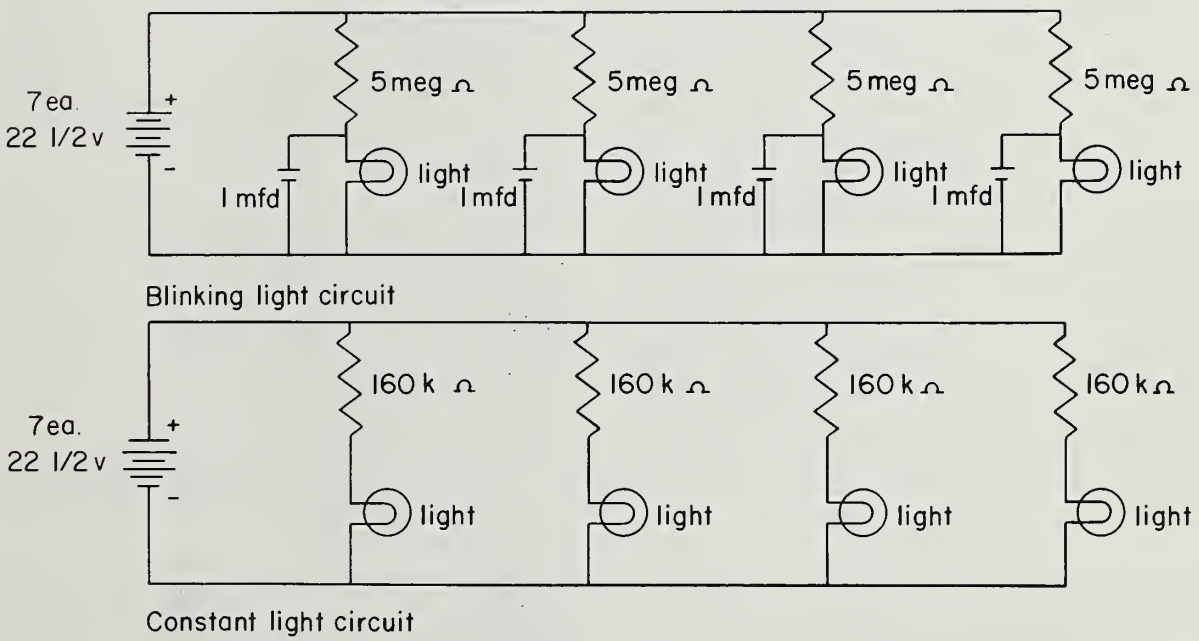


Figure 4.—Electronic circuits of constant and pulsating-light deer collars.

Table 1.—Total listing of materials and costs for the described collars.

No.	Item	Description	Unit cost	Total
2	Collars	Polyvinyl impregnated nylon (10.2 by 55.9 cm)	$3.68	$ 7.36
4	Lenses	Type 137-0937 clear	.51	2.04
4	Lamps	Type N E2J (C 9 A) 105-125 volts, ¼ watt	1.60	6.40
4	Lamp holders	Neon Subminiature Type 137-8864-09-532	3.41	13.64
7	Batteries	22½ volt M-505 Mallory electronic	2.00	14.00
2	Holders	Number 182 Keystone battery	.74	1.48
3	Buckles	1.3 cm roller	.10	.30
1	Strap	Leather (1.3 by 81.3 cm)	.60	.60
22	Rivets	.79 cm tubular	.02	.44
1	Foam rubber	1.3 by 20.4 by 55.9 cm	.50	.50
1	Tape	Roll of 2.54-cm filament reinforcing	.76	.76
2	Hours (labor)	Contract for leather, rivet work	7.50	15.00
4	Resistors	½ watt ± 10% tolerance	.28	1.12
	Wire	¼-spool, 20-gage Belden electrical	7.44	1.86
	Solder	20-gage, 5-core, ¼-pound spool multicore resin flux	4.34	1.10
			Total for constant light collars	$66.60
4	Capacitors	1 mfd 200 volts (Blinking light collars only)	2.73	10.92
			Total for blinking light collars	$77.52

Performance

The only major problem encountered with the collars was short-circuiting during an unseasonal rainstorm. Snow was never a problem. It is suggested that future units be encased in clear resin or dental acrylic (Mech et al. 1965) to insure durability and resistance to moisture. A minor problem was caused by deer chewing on the leather straps, but this was minimized by shortening the straps. The life of the straps was prolonged by dressing the leather with silicone.

Collars with blinking lights performed 6 to 8 months on one set of batteries, but longevity of the constant-light collars was 6 days or less. Reducing the number of lamps from 4 to 2 increased the battery life on constant-light collars about 24 hours. A light-sensitive switch which would turn off lights during daylight hours could double battery longevity. Additional lamp patterns, sequences, and/or intensities could easily be designed to increase the number of distinguishable animals.

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